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Case Report

Nucleated red blood cell count in beta thalassemia major: a case report

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Abstract

The complete blood cell count (CBC) is one of the most frequently requested laboratory tests, but some values included in the test may be overlooked. This case discusses a potentially underutilized value: nucleated red blood cell (NRBC) count. NRBCs are described as immature forms of erythrocytes that are normally found in the bone marrow but not in the peripheral blood of adults. In this case report, we were able to explain the abnormally high white blood cell (WBC) count in a patient with thalassemia major by measuring the NRBC that can normally be found. Thus, we have saved time and money by avoiding unnecessary research.

Keywords: Beta thalassemia major, hematology, nucleated red blood cells.

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INTRODUCTION

Thalassemias are a heterogeneous group of diseases characterized by hypochromic microcytic anemia resulting from damaged synthesis of one or more hemoglobin (Hb) chains (1). Nucleated red blood cells (NRBCs) are defined as immature forms of red blood cells that are normally found in the bone marrow but not in the peripheral blood of adults. The presence of NRBC in the blood in adults occurs in conditions of hematopoietic stress such as severe infection, severe bleeding, bone marrow infiltration, or extramedullary hematopoiesis (2). Due to the use of automatic hematology systems in clinical laboratories, achieving accurate results has become low-cost, fast and reliable. One of these developments is that automatic blood count devices can count NRBC. In some automatic blood count devices, the presence of NRBC is presented as a warning to the device user. Warning of presence of NRBC requires microscopic examination resulting in longer time to results and increased cost (3). Microscopic examination that requires expertise and experience; it has disadvantages such as repeatability problem, sampling error, and inability to detect samples containing a small number of NRBCs. As a result of today's technical developments, automatic blood count devices have become able to determine the NRBC parameter with significant accuracy. NRBC counts in automated hematology systems have been reported to correlate well with manual microscopy (4). Thanks to the NRBC counting in automatic hematology systems, the efficiency of clinical laboratories has increased, the time to give results has been shortened, and the costs have been reduced. In addition, the disadvantages of microscopic examination were avoided by standardizing the results.

In this case our aim is to determine that the NRBC count is greater than zero in the complete blood count sample that comes to our laboratory and to show that the automatic blood count system that does not count NRBC causes false high white blood cell (WBC) results.

CASE REPORT

A 48-year-old female patient was admitted to the internal medicine outpatient clinic of Hitit University Erol Olçok Training and Research Hospital with complaints of muscle weakness and fatigue. It was learned that the patient had a history of thalassemia major, so she received blood transfusion once a month from the age of one and received iron chelation therapy. In addition, it was determined that she had been using insulin for 10 years due to type 2 diabetes mellitus and splenectomy was performed in 2014 year. In the physical examination mucosa and skin were pale, the forehead was wide, and the zygomatic and maxillary regions were prominent. Blood pressure of 135/80 mmHg, a pulse rate of 110/rhythmic per minute, and a respiratory rate of 20 per minute. Cardiovascular examination revealed a 2/6 systolic murmur. Abdominal examination showed a splenectomy scar. Complete blood tests measured with the Sysmex XN-1000 in laboratory tests showed microcytic hypochromic anemia. Hemoglobin (Hb) was 8,6 g/dL, mean corpuscular volume was 68 fL, and mean corpuscular hemoglobin was 20 pg. WBC was found to be 37.71 $x10^3$/ul. In the iron panel, serum ferritin level was 1180 ng/mL, serum iron was 419 µg/dl, and transferrin saturation was 89%. Among other laboratory tests, serum glucose:441 mg/dL, HbA1c:10.2%, serum calcium:8.7 mg/dL, phosphorus:7.8 mg/dL and serum albumin was 3.8 g/dL. When the patient's WBC value was elevated, the cause was investigated. Infection markers such as C-reactive protein (CRP) and procalcitonin were normal. In addition atypical cells could not be detected in the peripheral smear. NRBC measured with Sysmex XN-1000 was 21.28%. The detected WBC was high because it contained NRBC cells. In fact, since NRBC cells are not white blood cells, the patient's actual white blood cell count was determined as 16.43 $x10^3$/ul. Thanks to the detection of this, we saved our patient from additional examination and cost.

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DISCUSSION

NRBC are immature red blood cells with a nucleus. Ordinarily, they are not observed in peripheral blood after the neonatal term. At birth, there are between 3 and 10 NRBCs for every 100 WBC cells, and preterm birth or fetal hypoxia can lead to NRBCs to elevate (5). The presence of NRBC in the peripheral blood of adults indicates bone marrow disease or non-haematological situations and potentially serious underlying diseases (6). The existence of NRBC in thalassemia has been known for a long time. Their appearance in peripheral blood is an indication of excessive increase in erythropoietic activity or activated extramedullary hematopoiesis (7). Danese et al. reported that NRBC count was well correlated with ineffective erythropoiesis (8). The severity of erythropoietic activity, which can be measured by NRBC count, was suppressed above 10 mg/dL of Hb (9). Therefore Increased circulating NRBC is a reflection of unsuppressed ineffective erythropoiesis in thalassemia patients. Also, increased circulating NRBC may estimate unoptimized transfusion therapy in the severe thalassemia major patient (10). It was suggested that NRBC count of less than 5% was an indicator of adequate transfusion therapy in transfusion-dependent thalassemia patients (11). Recently, a fast, automated and accurate NRBC count has become possible, allowing this parameter to be determined in a very large group of patients with these automated devices (12,13). NRBCs are escalated in acute hemolysis, violent hypoxia, and in thalassemia syndromes. Thus, automated NRBC count is extremely beneficial to exclude a fake rise in WBC count, which is important in neonatal patients with sepsis and low WBC counts. As a result NRBC count should be routinely performed for adult patients if clinically is necassary (14).

CONCLUSION

Detection of NRBC by the Sysmex XN-1000 analyzer has many advantages over manual counting and can help avoid unnecessary research, wasted money and time for patients with beta thalassemia major.

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